POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

TELLS YOU HOW TO DO THINGS. WRITTEN SO YOU CAN UNDERSTAND IT.

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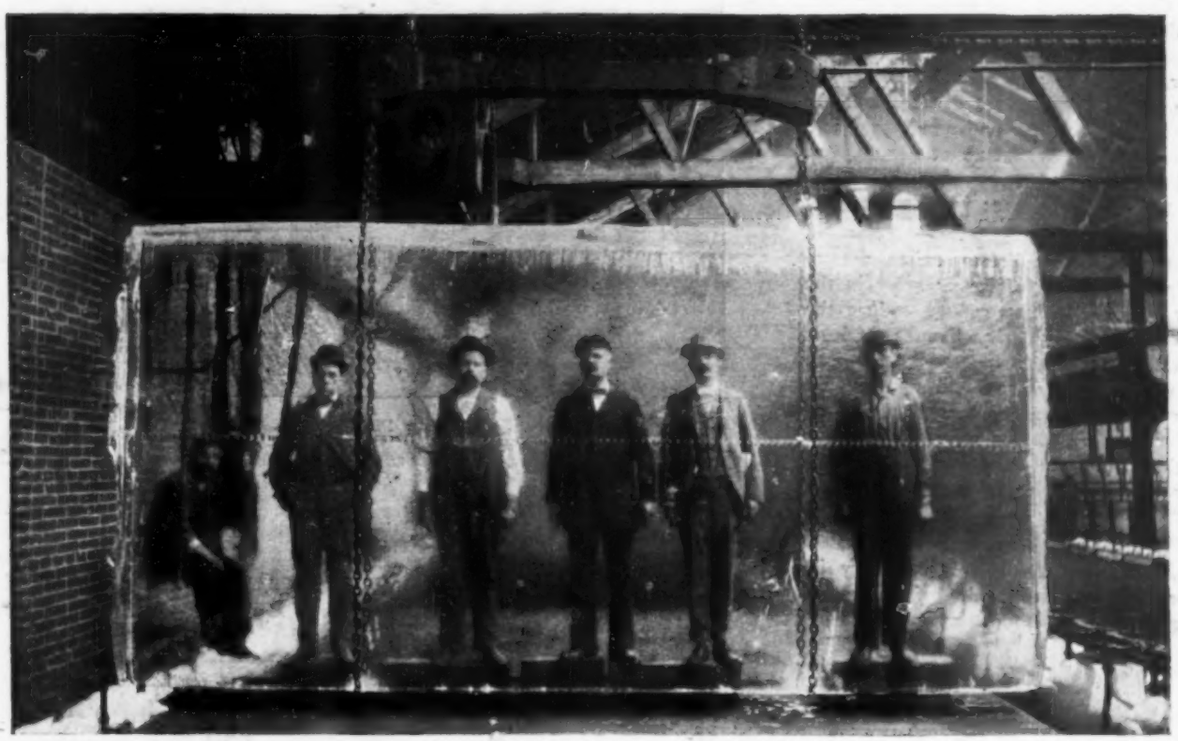
ASTOR, LENOX AND TILDEN FOUNDATIONS

Largest Cake of Ice Ever Manufactured

How It Was Made



Cake of Artificial Plate Ice, 16 feet long by 9 feet high

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Ice--What It Is and How It Is Made

All that is Necessary is to Extract the Heat From Water and It Becomes Ice

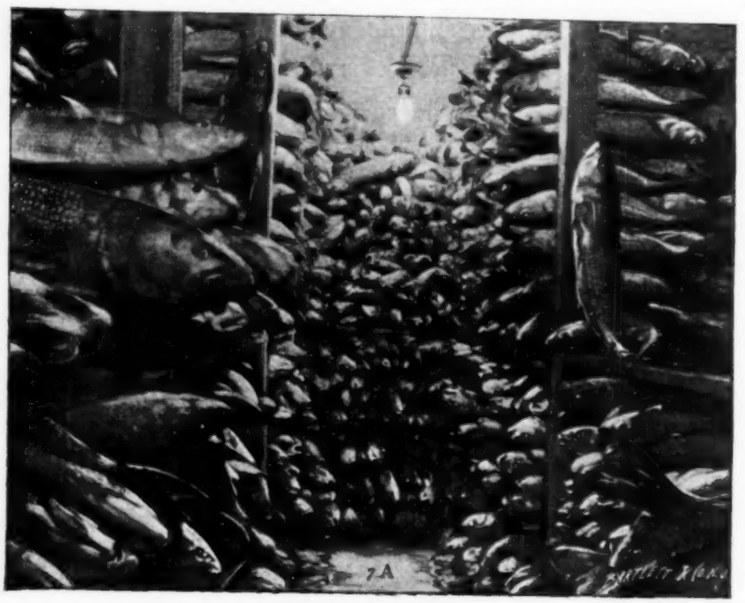
Nothing is simpler than the theory of ice making. All the manufacturer has to do is to extract the earth's heat from water and the water becomes ice. Cold is the absence of heat. Water is simply melted ice. Ammonia serves as the greatest factor in drawing the heat from water and thus converting it to its solid state—ice. Other mediums than ammonia, however, are used, such as compressed air, ether, chloride of methyl, etc., but ammonia is now used more than all the others combined because of its great powers of evaporation.

Every solid has its melting point, which may also be regarded as the freezing point of the corresponding liquid. Thus ice melts at any point above 32 degrees and water freezes at any point below 32 degrees. Tin melts at 442 degrees and the molten tin will freeze or be converted into the solid state again at about 442 degrees. Lead melts at 633 degrees, zinc at 842; silver, 1832; copper, 2012; iron, 2012; gold, 2287; steel, 2462; osmium, 4532.

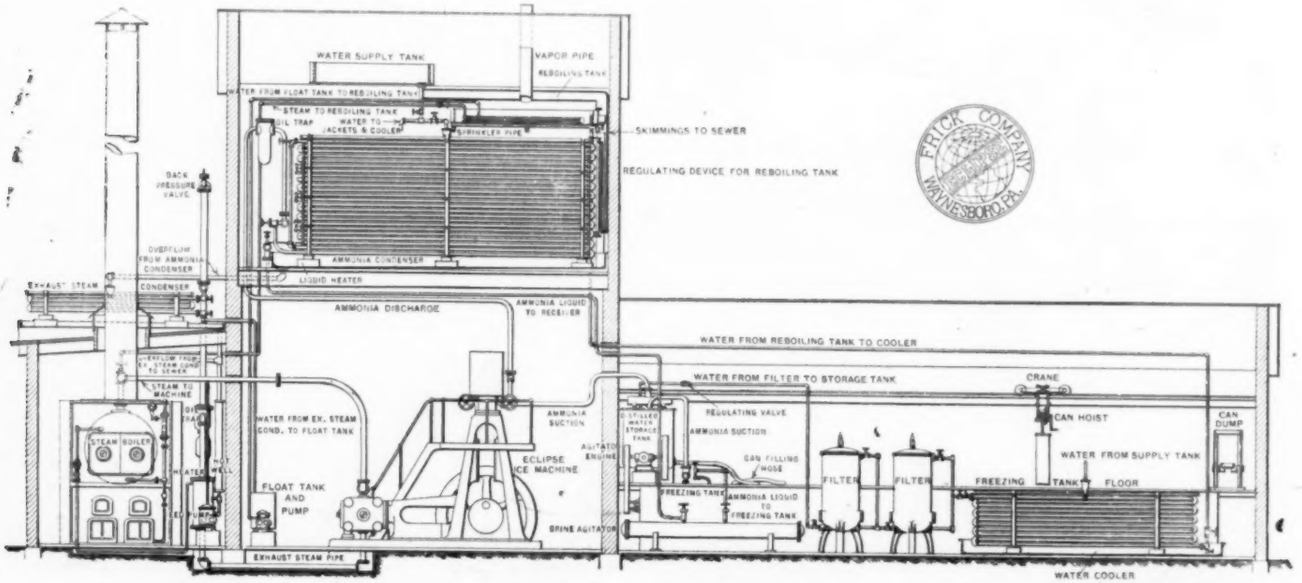
Water in its solid state exists permanently in the form of ice or snow in the polar regions, but it cannot endure the heat of more southerly climates and is converted into a molten state just as iron is transformed from a solid to a liquid under the much greater heat of the foundry furnace. If the sun were extinguished and the earth's source of heat removed all water would at once revert to its solid state.

Hence in the manufacture of ice such machinery is required as is necessary in the process of extracting heat from water. There are two methods most generally employed, the can system and the plate system. In the can system the water is placed in cans or molds of galvanized iron of convenient shape which are inserted in a tank filled with brine, the latter being kept cool by coils of pipe in which the expanding ammonia circulates. The brine is kept at a temperature of between 10 and 25 degrees.

The salt brine is a medium for conveying the heat in the water to the expanding ammonia as the ammonia passes through the pipes into which it is forced by a machine known as the compressor. The liquid ammonia boils, or expands, at 29 degrees below zero. Hence when it gets beyond this temperature it begins to evaporate, and in doing so takes up the heat from the surrounding surface. As soon as it evaporates it becomes a gas. In this gaseous state it passes again to the compressor and condensor which convert the ammonia back into a liquid state that it may continue its work of circulating through the pipes and carrying away the heat from the brine. The condensor is a system of pipes which are cooled off by running water which, takes away from the ammonia



Frozen Fish Storage.



Showing Arrangement of Complete Ice Factory.

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in the coils the heat which it has acquired through the compression as well as the heat which it has absorbed while evaporated in the expanding coils. Owing to both pressure and withdrawal of heat the ammonia assumes its liquid form again to pass into the expanding coils, thus repeating its circulation over and over again.

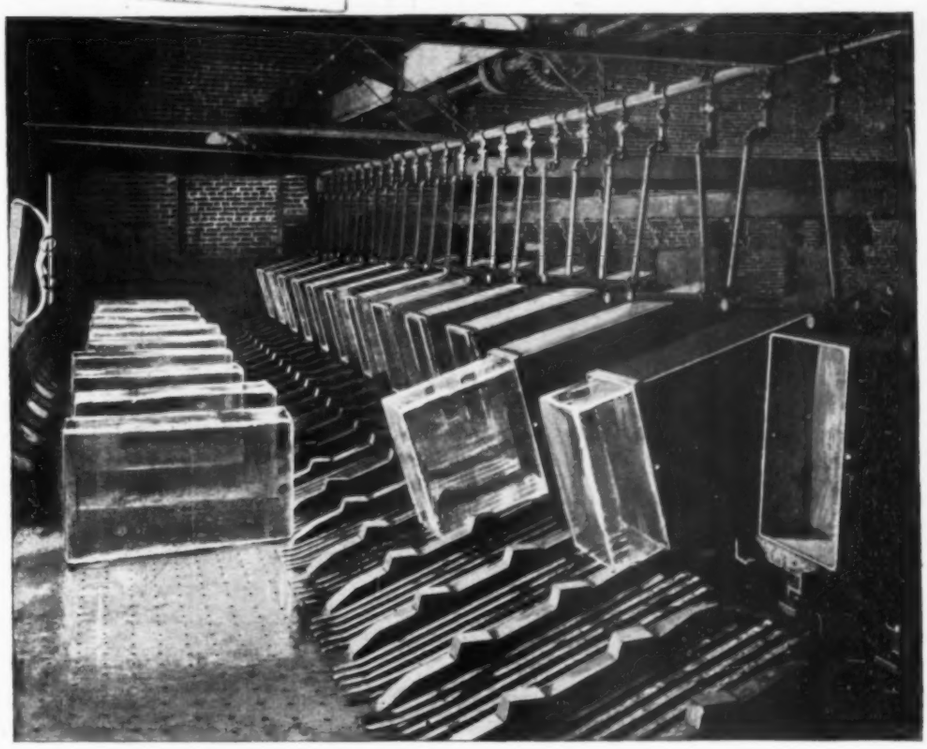
The freezing system embodies a perfect cycle of operations. The working substance, ammonia, returns periodically to its original condition. During each period a certain amount of heat is added to the ammonia and an exactly equal amount is extracted from it in the condenser by the cooling water.

The compressor is a strongly constructed cylinder in which a piston moves to and fro having a valve through which the expanded ammonia from the coils in the ice freezing tank enters and another through which it is forced into the condenser. The compressor, like all other parts of the ammonia system, must be made of steel and iron, no copper or brass being admissible.

The temperature of the ammonia will always be a few degrees higher than water leaving the condenser and the ammonia in the coils in the ice freezing tank will always be a few degrees lower than the outgoing brine.

The surplus heat in the compressor is removed by injecting refrigerated oil, by surrounding the compressor with a cold water jacket or by carrying liquid ammonia into the compressor, etc.

In the plate system of manufacturing ice hollow plates are put into tanks filled with water, and ice forms gradually on both sides of the plates. The largest cakes of ice known are made by means of the Eclipse Patent Plate system, a device of the Frick company, Waynesboro, Pa., manufacturers of all kinds of high-class ice machinery. The cake of ice shown on the title page is the product of the Keystone Cold Storage Company, of Reading, Pa., equipped with Frick machinery. Its enormous size and wonderful transparency can be appreciated when noting the comparative height of the half-dozen men on the opposte side and how clearly visible they appear. This plate of ice is 16 feet long, 9 feet high and 16 inches thick. The men, it will be seen, are standing on blocks of wood and the ice towers high above their heads. So clear is the ice that the features of the men are plainly discernable in the photograph, which is regarded as a rare possession. In the Eclipse Patent Plate system the impurities of the water are forced out in the process of freezing and are found as a precipitate at the bottom of the compartment at which the ice is frozen. This ice may be split into convenient sized blocks in the same way as natural ice. The system is employed in sanitary ice making. The mammoth plates of ice are hoisted from the freezing compartments and transported to the cutting table by means of huge geared traveling cranes.



Dumping Ice From Cans.

In refrigerating plants the process of producing temperatures of divers degrees of coldness is identically the same as in the manufacture of ice.

FUNCTIONS OF THE FACTORY OFFICE.

One of the most important functions of a factory office is acting as a bureau of information to the stores department, regarding market prices, current discounts, and the best sources of supply. In many cases circumstances are such that the purchasing can be done to greatest advantage by the store keeper instead of operating a distinct purchasing department. In such case the factory office should be able to supply full information on these subjects. It should have accurate and systematic records of all quotations asked for or received by the company, and in the case of special goods being required, it is the factory office that should procure all information concerning them.

To the shops the factory office stands in a dual position. To each it should represent all other shops and departments, in so far as clerical work or records are concerned. To all the shops it should represent all customers for whom work is being done or goods manufactured. It should be able on demand to inform the drawing office, assembling room, or erecting shop how many of the various parts or articles about which they may require information are either in stores, in process of manufacture, or on order for outsiders, as well as the probable date of completion, or receipt of the latter. It should always be the source of communication between the superintendent or any of the shop foremen and a customer. If the shop requires details regarding work or manufacture from either the management or a customer, they should be asked for and reach them through the factory office, and should either the management or a customer make inquiries regarding any work in progress they should be addressed to and answered by the factory office.—Engineering Magazine for May.

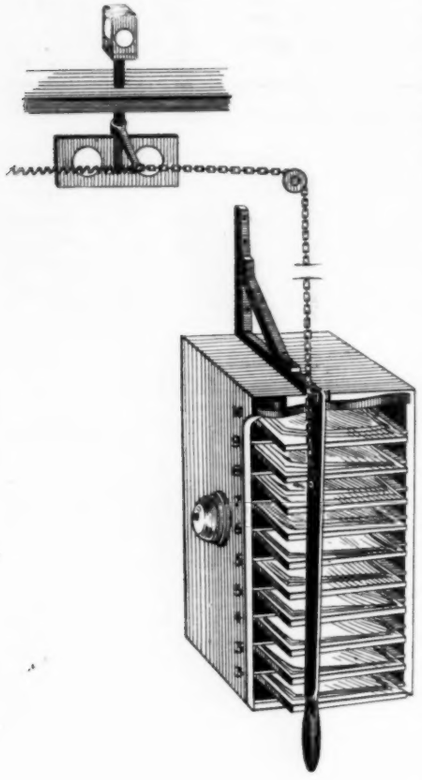
THE MEXICAN LABORING MAN.

Mexican laboring men work for 12 cents a day. This may seem incredible, but it is a fact. You see more copper cents in that country and more are used, perhaps, than in any other country on the globe. It is not uncommon to see a Mexican woman go to market and buy a cent's worth of wood, a cent's worth of corn or coffee, and a stalk of cane. She will make a fire in the center of her adobe house and prepare a meal for the family. They eat cane as we would an apple. The ox cart and wooden plow are still in use. The ox teams are harnessed so the pressure of the load comes upon the head, just in front of the horns, instead of the shoulder and neck.

TO PREVENT RAILROAD COLLISIONS.

New System Invented by a Railroad Man—Grand Trunk Ry. Giving It a Trial.

The most serious railroad accidents of recent years have not been caused by breaking of rails, bridges or engines, but have occurred when all these factors were in perfect working order. With increased business has come more and faster trains. This has thrown such responsibilities on train dispatchers that the men wear out in a few years. Even when the dispatcher has given an order he cannot be certain



that an agent miles away will execute it properly.

Mr. E. Peterson, Grand Trunk Railway agent at St. Hilaire, Que., has had patented a device which has for its object the prevention of collisions caused by operators forgetting what train orders they have in their possession. The device, it may be said, briefly, consists of a convenient box or receptacle for train order blanks, placed immediately behind a semaphore or signal board lever which virtually locks its contents (the order blanks) till the lever is raised from across it; this process puts the semaphore or signal board at "danger," thus preventing an operator accepting train orders for delivery before it is so set. Should an attempt be made to lower the semaphore or signal board lever before the object of the extracted order blank has been accomplished and the blank returned to the box, the operator is warned by an electric bell. The bell also rings should the semaphore or signal board fail to properly respond to the lever.

Mr. Peterson has his patent in working condition at St. Hilaire, and has had it examined by the Grand Trunk Railway officials, who express themselves favorably. It is not at all unlikely that the device will be adopted by a good many American as well as Canadian railways as soon as they become familiar with it.

WORK ON THE PACIFIC CABLE BEGINS.

The first steps in the construction of the cable between San Francisco, Honolulu and Manila has been taken in beginning the building of conduits in San Francisco. The laying of the cable will begin in a few weeks. The work is being done by the Commercial Cable Company, headed by John W. Mackay, whose company owns the Atlantic cable lines. The entire construction will cost about $20,000,000.

BILLION GALLONS OF PETROLEUM EXPORTED LAST YEAR.

In 1901, for the first time in the history of the trade, the total number of gallons of petroleum and its derivities exported from the United States exceeded 1,000,000,000, the number of gallons being 1,062,750,306, a gain of 9 per cent over the exports of 1900. The value of these exports in 1891 was $71,479,124. The average price received for all grades of petroleum exported from the United States in 1901 was 6.73 cents per gallon, as compared with 7.52 cents per gallon received in 1900 and with 6.83 cents per gallon in 1899.

INVENTION OF THE HORSESHOE.

Iron horseshoes permanently attached to the hoofs were invented in the fourth century of the Christian era. On the grassy plains of Asia and on the open ground elsewhere shoes were not needed; but the Romans soon found that their paved roads wore the hoof away and often lamed an animal when his service was the most needed. They could devise no better remedy, however, than leather soles and bags to protect the hoof, though, there is reason to believe that they had an iron shoe which they put on and took off at pleasure. Some writers are of the opinion that later Romans learned to nail the shoe under the hoof, but it seems possible that the crescent-shaped horseshoe of modern times was first invented in some part of Asia.

Prof. Moore, Chief of the Weather Bureau, Washington, has invented a cooling machine for houses and hospitals. It occupies the same amount of space and costs about the same to operate a hot air furnace for the same building.

WHAT TO DO FOR "ELECTRIC BLINDNESS."

The increasing use of the electric furnace is producing many cases of electric blindness. A writer in the American Electrician relates his experience: The eyes do not burn or pain at the time of exposure to the arc, but become very painful two or three hours afterward. Eyes so affected are very red, and have small white spots in them. I am informed that in many cases permanent injury is sustained, so that one canot be too careful in exposing the eyes to this powerful heat. As soon as any pain is experienced from this cause the eyes should be bathed twice a day in cold water, from 1½ to 2 hours each time, and one drop of the remedy specified in the accompanying prescription should be put in each eye every three hours: the cold water baths should be timed so as to come midway between two applications of the eye drops:

PRESCRIPTION FOR EYE DROPS.

Holocain Muriatic, 1-100.....3 grams
Adrenalin Chloride, 1-1000....3 grams
Distilled Water .....4 cu. cm.

The patient should remain indoors and wear very dark glasses until the eyes are entirely restored to their normal condition, and direct exposure to any light should be carefully avoided.

MILK SLOT MACHINE TO REDUCE DRUNKENNESS.

Temperance workers of Stockholm, Sweden, have placed milk slot machines on the corners in that city as a means of reducing drunkenness among people who are

forced to spend much of their time on the streets. A coin equivalent to 1½ cents is placed in the slot and the machine gives in return a cup of milk. In summer the milk is ice cold and in winter it is heated by means of a small gas stove which is placed under the supply tank inside.

MAKE LEATHER OF FISH SKINS.

Skins of fish and various kinds of animals that not long ago were considered useless are now found to make excellent leather. A northern firm recently manufactured shoes of the skins of codfish and cusk. Whip handles are made of sharks' skins. Porpoise leather make the finest razor straps, and whale skins make admirable leather for many purposes. Seal leather is made into pocket books and many other useful articles. Salmon hide makes waterproof shirts and hats for the Eskimos. Overalls of tanned fish skins are worn by the natives on the lower Yukon in Alaska. Walrus leather and sea elephant leather are seen on the market, but as both these animals are nearly exterminated it will amount to but little commercially.

HOW CLOTHESPINS ARE MADE.

Making clothespins is an industry that nets handsome returns to many American factories. At Martinsville, Ind., there is a factory which has a capacity of more than 200,000 clothespins a day.

A rough log started through the mill comes out as hundreds of the shapely little wooden pins familiar to the back yard clothes lines. The logs are cut into blocks about 16 inches long and with a headlong saw are cut into boards about 5/8-inch thick. A gang of saws cuts these boards into strips 5/8-inch square and each long enough to make four pins. These strips are placed on an automatic trimmer and cut to the required length. They are then conveyed to the automatic lathes, seven in number, each with a capacity of four dozen a minute. From the lathes the pin drops to the slotting machines and from these to the dry room where all moisture is removed. Next they go to the polishing cylinders, which are filled about half full of pins, chips and sawdust. The cylinders are revolved slowly for four hours when the pins are dropped into the chutes to be conveyed to the packing room. Each lathe has a capacity of 2,400 dozen pins a day.

TELL THE AGE OF EGGS TO THE DAY.

Germans have a process by which they claim to be able to determine the age of an egg to the day. The egg is dropped in a solution of salt containing eight ounces to the pint. If the egg is only one day old it sinks immediately to the bottom; if three days old it sinks just below the surface only, and from five days upward it floats.

It is well known that the air cavity at the blunt end of an egg enlarges as the age of the egg increases. When the egg is placed in the salt solution it will have a tendency to float with the long axis vertical. A scale of angles is placed at the back of the vessel, and from the inclination of the egg to the horizontal, it is said, the age can be gauged almost to the day. A new laid egg lies horizontally on the bottom of the vessel. When three to five days old it raises itself so that its long axis makes an angle of about 20 degrees with the horizontal. At eight days the angle increases to about 45 degrees; at 14 days it is 60 degrees; at about three weeks it is about 75 degrees, while after four weeks it stands upright on the pointed end.

A Bad Mix-Up

Recent B. & O. Wreck, Newark, O.—Courtesy of Railroad Trainmen's Journal.

HOW CANALS DEVELOPED THE NORTHWEST.

The first locks at St. Mary's Falls were opened in 1855, in which year the registered tonnage was 106,296 tons. The half-million mark was reached in 1863, and the one-million mark was passed in 1873. In 1881, exactly coincident with the opening of a new and much larger lock, the northwest began to grow by leaps and bounds and the tonnage of the canal rose from 2,000,000 tons in 1882 to 9,000,000 in 1890 and to 16,000,000 in 1896. During the past five years two more enormous locks have been in operation, one of them on the Canadian side of the river, and in this short time the tonnage of the canal has leaped up to near 28,500,000 tons. This colossal tonnage is simply a manifestation of the development which has taken place in the northwest, along with which has come the building of thousands of miles of railroad, including two lines from the head of Lake Superior to the Pacific coast. If by some cataclysm of nature the Great Lakes should be dried up, the enormous traffic now carried on their waters would not be divided among the railroads—it would simply cease to exist. The whole galaxy of cities from Buffalo to Chicago and Duluth would be overwhelmed in hopeless, irretrievable ruin, and the railroads could in no wise escape the general disaster.—Engineering Magazine for July.

LIGHTING ST. PAUL'S CATHEDRAL, LONDON.

Three years have already been spent in running the electric wires in great St. Paul Cathedral, London. The lighting is the gift of J. Pierpont Morgan, and has already cost $60,000. The hanging lamps in the dome weigh 500 pounds and are suspended by wire cables of which 16 miles have already been used. The wires lead through massive foundations 200 years old and weave in and out among the vaults and tombs beneath the stone floor.

According to tests made by German health officers, borax in the human system retards the assimilation of albumen and fats and interferes with the renewal of tissues. A single dose of borax remains in the system eight days.

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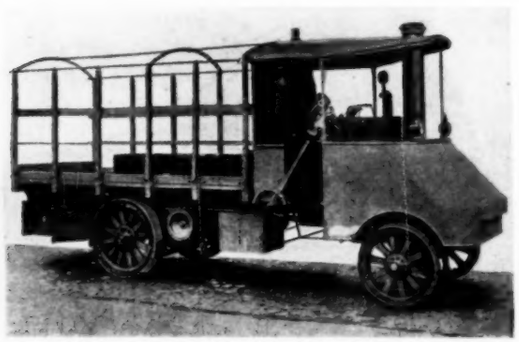
CATCH FISH TO RUN THE TOWN.

A peculiar industry in the town of Warren, Me., is the catching of alewives, which has been followed since the early history of the place, says the Maine Journal. The alewives, a species of shad, go up the Georges about this season of the year, and in attempting to ascend the fishway at the Lower Falls are caught in dip nets. The alewife catch is a sort of "community of interest" among the citizens, and is registered by law. Each head of a family in town is entitled to 300 alewives, at the nominal price of 20 cents a hundred. The town employs men to catch the fish, and the surplus is sold and the proceeds turned into the town treasury.

CURIOUS TYPE OF AUTOMOBILES.

The designing and manufacture of automobiles and motor vehicles is one of the most active industries of the present day. The Motor Age, published at Chicago, each week has accounts



Thorneycro't Steam Wagon.

of several new and very interesting machines. We illustrate three by the courtesy of that paper.

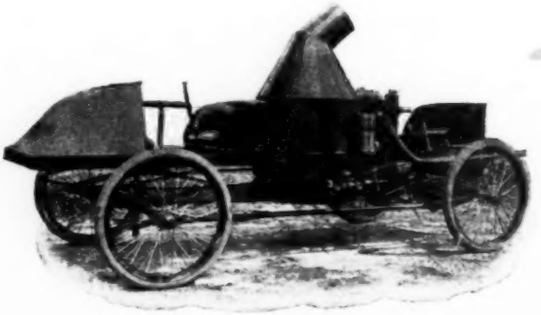
The Thorneycraft steam wagon, made in Germany, is one of the type which will soon displace all the heavy hauling by horses in cities.

The English "Fire King" is the first machine of its kind built for the London Fire Department. It is also steam propelled, and burns oil, of which a 30-gallon supply is carried. The oil is forced through the burners under a pressure of 40

New London Fire Engine.

pounds per square inch. The water storage tanks surround the boiler and hold 100 gallons. The vehicle frame is strongly built of steel.

The steam racer of George C. Cannon, whose trial at Staten



Interesting Steam Racer.

Island was prevented by the Baker accident, is an interesting machine. The steering wheel is in front, the driver being protected from the wind by a pointed steel shield. The engineer's seat is back of the boiler. Great results are expected.

TURBINE ENGINE FOR OCEAN RACERS.

Expert testimony would seem to prove conclusively that the turbine engine will have to be considered for fast vessels in the future—vessels that maintain for the whole of their trip about the same rate of speed. For this reason experiments may soon be made on an Atlantic liner, says the Marine Journal. In fact, it has been stated that plans have already been drawn for a large Atlantic passenger ship that is to be fitted with turbine engines, and that was expected to make twenty-five knots all the way across the Atlantic. If this can be obtained with no increased weight of engines over those now used by slower vessels, and if the adoption of oil fuel should also reduce the weight that has to be carried for a voyage, records may be made across the Aalantic that will be as much better than that of the present queen of the fleet, the Deutschland, as was her record better than that of the vessels that were considered record-breakers five years before she was launched.

WOMAN JEALOUS OF BRASS WIRE.

Found Some on Husband's Shoulder—Thought It Was Real Hair.

Brass wire so fine that a woman's hair is coarse in comparison has been made in a factory at Torrington, Conn. It is almost as fine as cobweb, and has every appearance of having come from an auburn head. It is made by drawing a bolt of brass through steel dies and is then wound on a big spool by machinery. So fast does it coil up and so strong are these hair-wires that recently a workman who was caught on the spool had all his bones broken and the breath crushed out of his body in a few seconds.

An operator of one of the machines had an interesting experience the other day. He says: "My wife is mighty proud of her hair and is always bragging about it, so I determined to cure her.

"'Miranda,' says I, 'we can draw brass wire down at the mill which is finer than your hair.'

"She laughed, and said, 'I'd like to see it done.'

"'Give me one of your hairs,' says I, 'and I'll bring the wire home with me to-night.'

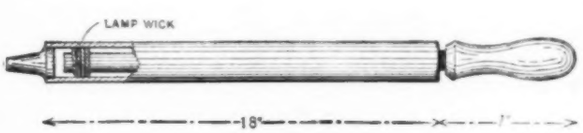
"She pulled out a long one and I used it as a sample. It was delicate work, but we soon had the wire as fine as the hair. It seemed that further drawing out was possible, so we kept at it. The result was a wire twice as fine as a hair. I put a yellow strand on my coat when I went home to dinner, and it was not long before she noticed it. Nor would she believe that it did not come from some woman until I showed her a ball of the wire."

UNDERMANNING IN THE BRITISH NAVY.

There is not a ship in the British navy today which has an engineer complement sufficient to maintain her in a state of efficiency. If that be the case in time of peace, asks Charles M. Johnson in the Engineering Magazine, what will be the condition of the navy in time of war? The basis of calculation for the engineer department of a British naval vessel is the number of men required to steam the ship at a little more than one-half the full power of the engines, developed during the official trials.

HOW TO MAKE A PLUMBER'S FORCE PUMP.

With the aid of a piece of 1½-inch tubing and a piece of round oak or ash a plumber may make his own force pump that will answer every purpose for removing stoppages from basins and waste pipe. The tubing should be about 18 inches long and may be made from pipe left over in fitting up a closet. An old thimble from a wash tray can be soldered on one end of the tube for the nozzle. The piece of round oak or ash serves for the plunger. It should have a handle extending about 7 in. beyond the chamber. Around the lower end, says the Metal Worker, a recess should be cut about ½ in. wide and ⅛ in. deep, to be filled with twine or lamp wick, to make it fit the chamber

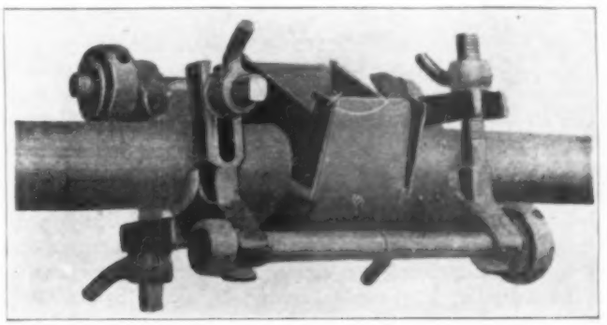


A Home Made Force Pump.

tight. If the nose of this is put into a stopped up waste or service pipe and the chamber filled with water a considerable force can be developed to dislodge the stoppage. On the other hand, a very strong suction can also be brought into effect. Such a pump is also very handy for absorbing the water from holes around a drain pipe while making calked points, or for freeing a main where water collects.

WELDING PIPES BY CHEMICALS.

At the Dusseldorf Exhibition there is shown a method of welding iron pipes, rails and bars by means of chemicals. The system is based on the strong natural affinity of aluminum and oxygen for each other. The Engineering Times, London, says:



Illustrating the "Thermit" System of Welding Pipes.

"On bringing these two elements under certain conditions together, a chemical reaction is started of so rigorous and energetic a nature that a temperature, previously obtained only by electrical means, is generated with almost instantaneous rapidity. The oxygen necessary for the combustion is obtained from its chemical combinations, principally the metallic oxides, and not from the atmosphere. The proccess of welding gas and water pipes consists in clamping together the two tubes to be welded and then casting on the joint a molten admixture of slag and metal at a temperature of some 3,000 C., in order to bring the iron up to a welding heat. The increase of temperature causes the pipes to expand, but they are prevented from doing so longitudinally and outwardly by the clamps. The expansion, therefore, taking place within a restricted area, acts as a weld-

Crucible and Tongs Used for Small Sized Pipes.

ing force upon the tube faces, and presses the hot malleable iron together, being further assisted by a screw arrangement on the spanning mechanism. Our second illustration shows the crucible and tongs used for small-sized pipes. The process is known as the 'Thermit' system."

DRIED POTATOES IN GERMANY

Drying potatoes is a new industry in Germany. There the potato crop is one of the most extensive in the country, and various methods are devised for its preservation. Forty per cent of the total crop is used as fodder, but even in this state the potatoes will not keep longer than seven months.

The method of drying potatoes is yet not all that is desired, and to encourage the industry a prize of 30,000 marks ($7,143) has been offered for the best process. Particulars regarding the prize contest will be furnished to any one on application to the "Institut fur Gahrungsgewerbe," Berlin, N. 65 Seestrasse.

John Milliken, Belfast, Ireland, has invented a "date" nail. The head of the nail bears figures indicating the year. The nails are driven into telegraph poles, etc., to furnish reference as to when erected or repaired.

Easy Electrical Experiments FOR BOYS

By L. P. Dickinson

CHAP. XXVII.—HOW TO MAKE A TELEPHONE—PART IV.

(CONCLUDED.)

The different parts of our telephone should be supported on a suitable backboard which holds them firmly in place, and enables us to support the whole instrument on the wall. This backboard should be made from a piece of ⅞-inch board. It should be about 20 inches long and 10 inches wide. Fasten the box containing the movable hook to the upper part of this board by screws passing through the bottom of the box. Fasten the transmitter first constructed at a convenient distance below this in a similar manner. There will be needed, in addition to the apparatus constructed, an ordinary electric bell, a push button such as is commonly used for doorbells, and about five cells of dry battery such as was described in the issue of June 14 of this paper.

Mount the electric bell in a convenient place near the telephone. Connect one terminal of the bell to one of the binding posts on the left-hand side of the box containing the hook. Connect the other terminal of the bell to one cell of dry battery. Connect the other terminal of the battery to the binding post immediately below the first one just mentioned. Mount the push button on the front of the telephone as shown at P, and run a wire from it to the upper left-hand binding post, and a wire from the button to another binding post screwed to the backboard, and shown at S. Join four cells of dry battery in series, and connect one terminal of the battery to the upper right-hand binding post. Connect the other terminal of the battery to the binding post S. Connect the binding post on the right-hand side of the box to the right-hand binding post on the transmitter.

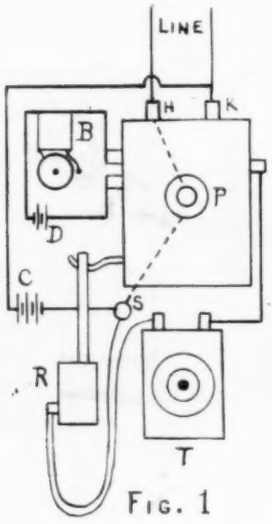


FIG. 1

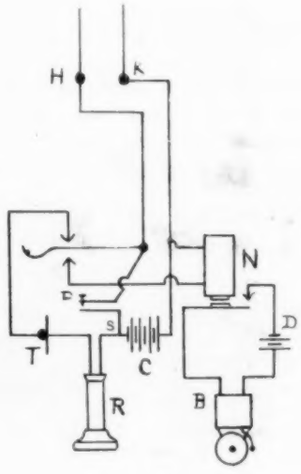


FIG. 2.

Provide now two pieces of flexible wire about three feet long and insulated. Connect one end of each to the binding posts on the receiver, and the other end of one to the binding post S, and the end of the other to the remaining terminal of the transmitter. This finishes our connections, and all that remains now is to adjust the different parts and study their action. The connections just described are indicated in Fig. 1. In Fig. 2 is given a diagram which illustrates the principles upon which the apparatus works.

First as to the adjustments necessary. The receiver will require the least adjustment, and if made according to the directions given, should work perfectly. The transmitter should be carefully examined to see if the powdered carbon is still in its place between the two carbon terminals. These terminals should be mounted with the precautions described. The terminal attached to the diaphragm should move freely with the latter. The back carbon terminal should be firmly fixed in place. The hook should next be examined carefully to see if it moves freely up and down. Notice especially if it makes and breaks the circuit between the two contact springs as described. Examine the spring carrying the armature to the ringing coil described in the last number and adjust it so that the armature will be attracted towards the coil with the least possible current. Be sure that the armature makes contact with the screw mentioned in the preceding paper.

Turning now to Fig. 2, let us see how our telephone should work. The line which connects our telephone with that of the person with whom we are talking is connected to the two binding posts at the top. If the receiver be hung on the hook so as to pull the latter down there will be a circuit from H to the hook, to the lower contact point, to one terminal of the coil N, and from the coil back to K and thence to line. If a person at the other end of the line should connect a battery to the line the current would pass through the coil and would draw its armature up, ringing the electric bell.

Suppose, now, that the receiver be taken from the hook so that the latter may move upwards by reason of the spring previously described. Then the hook will break contact with the coil N and will make contact with the upper contact point. This will throw into circuit the transmitter T, the receiver R, the main battery C and the line. We are then ready for talking. When the telephone is not in use the receiver should always be hung on the hook to save the battery.

One thing more needs to be described. The push button indicated at P connects the battery directly across the line. When this is pushed the current from the battery goes directly to line and actuating the armatures of the coils at each end, causes them to ring the electric bells connected in circuit with their armatures. If the line be very short and the armature of the coil N very delicately pivoted, then the act of removing the receiver from the hook at one end will ring the bell at the other end of the line.

THE MISTAKES OF EDISON.

The automobile manufacturer looked sad. "I have been reading," he mournfully remarked, "what this unfortunate man Edison says about making automobiles for $150. It's painful, isn't it? Why, do you know that the wheels alone will cost $109.76—to say nothing of the tires And then there's the axles—I'd hate to tell you what the axles cost. It's way up. And the body of the vehicle, and the seat, and the coach varnish—do you know anything about the cost of coach varnish? You'll get scared when you hear what it is. And the levers, and the brake, and the bells—bells are awful high just now. And then the battery. Why, it costs money even to look at a battery! And then think of the expense of assembling the parts! And the wiring, and the ammeter, and the lamps, and the volt meter, and the sundries—and sundries went up steen per cent in Chicago last week. Why, it's an honest fact that you can't build an automobile that's worth bringing in out of the wet for less than $985.53—and second grade upholstering at that—Cleveland Plaindealer.

An electric automobile in England recently ran 97 miles on one charging.

LOCOMOTIVE WITH WATER TUBE BOILER.

An English Engineer Has Built and Successfully Operated One.

Dugald Drummond, chief of the motive power department of the London & Southeastern Ry., has decided to change most of their locomotives from fire-tube to water-tube boilers. The London Times says: "There are a few side tubes of the fire-tube type which are, however, used for stays, and need not be considered, as but little gas passes through them. There is, first of all, an outer shell, in appearance exactly like that of an ordinary locomotive boiler. Inside this there is an inner shell, the axes of the two being parallel, though not concentric. The appearance of this part of the structure is that of a Cornish boiler; but in place of the furnace being inside the cylindrical part of the boiler, the latter is attached at its rear end to a fire-box, which thus forms the furnace part, as in an ordinary locomotive. It remains to explain the arrangement of water-tubes. A certain number of these, say about forty, are in the fire-box, as already explained; the remaining tubes cross the space enclosed by the inner cylindrical shell (really a flue), being placed at angles sufficiently inclined from the horizontal to insure circulation of the water within them. It will thus be seen that these water-tubes are in a stream of flame and hot gases that passes from the fire-box at one end of the boiler, to the smoke-box at the opposite end, their axes being at right angles to the flow of gases. As they slope in opposite directions with varying angles, a kind of trellis-work is exhibited in elevation, or when looking from end to end of the inner shell or flue, as one can when the smoke-box door is open. This allows the tubes to be cleaned on the outside, and any ashes that may remain in the bottom of the flue to be removed."

The English coal fields will be exhausted in 50 years. Germany burned $250,000,000 worth last year, but has enough to last 1,000 years.

Japan and Italy have caught the trust fever.

REMARKABLE GRANITE QUARRY FOUND IN COLORADO

Natural Beds of Stone in Strata as True as If Sawed or Tooled by Hand.

At the head of the Arkansas valley, within a few miles of the great mining camp at Leadville, Col., has been discovered the most remarkable granite formation in America. In reality the discovery is not a new one, for sixteen years ago a man by the name of Fisher, whose attention was attracted by the peculiar formation of the mountain where the valuable stone lies, dug out the granite by an antiquated process and sold it for nearly nothing. He did not realize its value, and even if he had his capital was so limited that he could not have successfully placed it on the market.

Lyman S. Atkinson of Colorado Springs saw the granite and believed it above the ordinary. He sent for Eastern experts and by them his suspicions were confirmed. Indeed, his fondest hopes had been surpassed in the verdict from their analysis. He has begun the active development of the quarry, and the first building to be erected of the granite will be the new city hall of Colorado Springs.

Face of the Quarry at "Barre, Col.," Showing Almost Perpendicular Strata.

The stone very closely resembles Barre granite, and hence the quarry has been called the "Colorado Barre." The Monumental News, a recognized authority on stone and stone quarries, says of the "Barre:"

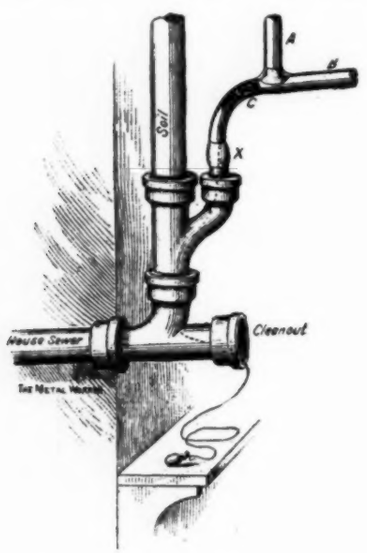
"Wherever tests were made the stone was found to be an unusually fine grained bluish gray granite. The stratification extends with perfect regularity for 1,500 feet to the east and the supply is only limited by the ability of the quarrymen to remove. The natural beds of the released rocks were found to be as true as if cut with saw or tooled off by hand. A test showed the granite capable of taking a polish as high as that of French glass of the finest quality."

The steel balls in the ball-bearings of automobiles should be renewed once in 2000 miles whether showing wear or not.

SHOP NOTES

DRYING PIPE BEFORE WIPING JOINT.

If a joint as at X or the bend gives way there is usually trouble in getting the pipe dry enough to solder. A writer in the Metal Worker gives the following valuable hint on how to dry the pipe: Take a long strip of strong, dry rag, attach it to a string with a lead "mouse" on the end, drop the mouse in at the branch hole or where the joint is to be rewiped and fish it out at the clean out. The rag strip is then folded back and forth, as indicated at C.



Drying Pipe Before Wiping Joint.

It should be folded about the size to make a plug that will push into the pipe tight, but which will come out easily by pulling on the string at the clean out. The rag plug is then shoved into the pipe tail first and pushed up above the point at which the joint is to be made. The waste should be swabbed out with cloth on a wire as far up as possible before putting the rag in. The plan will hold water back in pipes A and B, no matter how long they are, unless a regular deluge is turned loose at one of the fixtures, a mishap which there is some chance to guard against. In this way the joint is as easily wiped as on new pipe, and the rag string come out as easily as though it was a straight string.

WOODEN GASKETS FOR STEAM BOILERS.

An engineer in the South uses, for his steam boiler hand holes, gaskets sawed out of 5/8-inch white pine boards. They have to be screwed up about twice when heated up, and when taken out are about 5-16-inch thick. As they are cheap a new one is put in each time the boiler is cleaned.—Woodworker.

USES MIRROR IN SAWING LOGS.

At a hardwood sawmill in Michigan, says the American Lumberman, the sawyer has placed a mirror 2 by 3 feet in size back of the bumpers and practically on a line with the same. The mirror shows the defects if any and enables the sawyer to turn his log so as to saw to best advantage. A coarse-mesh wire screen protects the glass but does not interfere with the view.

WORKING OF THE STEAM ENGINE LUBRICATOR.

Almost every fireman seems to think the pressure of steam forces the oil out of a lubricator, writes W. H. Wakeman in the June Woodworker. This can not be true (in the sense it is usually taken), for if it were so it would require a very small and nicely-made valve to control the flow of oil. If men would stop and consider that the oil passes out of the lubricator against the pressure of steam, they would see at once that said pressure is balanced, hence can not force the oil anywhere. There is a column of water above the lubricator, the weight of which creates pressure that forces the oil out. If the standpipe, or condenser, is 15 inches high, there will be about one-half pound pressure to force out the oil, as it requires a column of water nearly 14 inches high to make half a pound pressure, and the condenser will not be full, because steam must have a chance to cool off before it will return to water.

It is very natural to ask why this condenser pipe is not made larger, and thus give a greater weight of water. That would not help matters so far as giving more pressure is concerned, for it is the vertical height that determines the pressure in a case like this. A pipe larger in diameter would enable the engineer to feed more oil in a given time, but when made ¼-inch in diameter, it is large enough to feed as fast as any engine ought to require, and very much faster than the average valves and piston can use it. Of course it is possible to run more than this through, but it would not be used.

HOW TO TEST PURITY OF MERCURY.

Mercury is almost invariably sold pure. If the quicksilver is suspected of being adulterated with lead, tin or bismuth—which is extremely unlikely—such mixture can be shown by rubbing some of the metal on the open palm. If it soils the skin, it is adulterated; if pure, it leaves no trace. If dosed with lead, the drops, instead of being gobular, will be elongated and flattened.

WHAT THE STEAM PUMP SAID.

F. Merian Wheeler happened to be standing by a steam pump and this is what he heard it say:

Please do not gorge me with oil, as it will give my steam chest indigestion. What I like is a steady diet, and thus enable my valves to work smoothly and with durability. A very small amount of oil fed to me steadily, is the thing—it saves oil and repair bills. Two or three times a year give me a good dose of kerosene to clean out any obstructions that may have accumulated in the passageways of my steam chest, or on the face or working parts of the valve and valve-seat, or on the chest piston.

Do all you can to make me make full length of stroke, as it means that I will use less steam and do better work. The adjustable collars on the valve rod will allow you to regulate the length of my stroke to a nicety. By allowing me to make short strokes you prevent my steam piston from getting in its proper cushion, which it would do if it could complete its full stroke. My steam piston is supposed to run up to the end of the cylinder and pass across the exhaust port, cushioning on the confined steam between said port and the cylinder cover.

The hand wheels on the side of my steam cylinder are for controlling the amount of this cushion. For slow speeds these cushion valves should be shut tight. When running at ordinary speed or a high rate of speed, these cushion valves should be slightly opened. Once in a while take a look at my water cylinder. See that the packing of the water piston is not set so tight that it makes me grunt, producing unnecessary friction and wear. Or, perhaps, the packing is too loose a bit, or is worn out and needs renewing.

Please see that my water valves are seated properly, because if they are not tight I cannot pump as much water as I ought to do for a given speed. Sometimes the springs on the backs of my water valves need renewing or looking after. If you have not already provided a good suction air chamber for my water cylinder, you ought to do it, because it will prevent the water column in the suction pipe from slapping the face of my water piston at the end of each stroke in a harsh manner and so produce "water hammer." A good suction air chamberfi properly located, saves wear and tear, and makes a pump run quietly.

Please keep me nice and clean. I may not be of as much importance as your big engine, but there is no reason why I should not be kept free from dirt and grease. I hate to have oil slobbered all over my steam chest or my stuffing boxes left leaking.

You will find it pays to keep me in good condition, like a well-groomed horse.

PRINCIPLE OF THE DIESEL OIL ENGINE.

The principle of the Diesel oil engine is not understood generally, but an engineering correspondent of the London Times has written what is probably one of the most lucid explanations of it yet published. In the ordinary engine the charge is compressed (before ignition) to a pressure varying from 40 to 80 pounds per square inch, and even more, and high compression leads to greater economy, though it is attended with many difficulties, especially in large engines; for one thing, the compression increases the temperature very much, and this might ignite the charge at the wrong moment. Diesel overcomes this difficulty by compressing air alone in the engine cylinder to a pressure of 500 pounds per square inch; in a pump separate from and worked by the engine is a second charge of air, not so highly compressed as the first, and this is employed to treat a certain amount of oil, pass it through a number of small holes, and force it into the engine cylinder in the form of fine spray; the heat evolved by compressing the cylinder charge causes the mixture to ignite, and whereas in the ordinary engine the flame, tube, or spark ignition causes a sudden and violent explosion, the Diesel automatic ignition is a more gradual burning of the oil, the rise in pressure also being more gradual. Thus a more equal turning moment is obtained on the crank-shaft. The trouble of starting a Diesel engine would be greater than with an ordinary motor, owing to the greater compression required, were not a special device employed. Whilst the engine is at regular work, a certain amount of compressed air is admitted to a reservoir and stored there. When starting the engine, this compressed air is admitted to the cylinder and motion is set up, just as it would be with an ordinary steam engine; after a few revolutions the air supply is shut off and the engine begins its regular work. According to Prof. Unwin, the best efficiency of the Diesel motor is 37 per cent.

EMERGENCY REPAIR OF LARGE STOP VALVE.

A noteworthy feat in marine engineering was accomplished by the engineers' staff of the Empress of India on her last voyage to the Orient, says Age of Steel. The casting of a large stop valve in the pipe conveying the steam from one of the boilers to the main pipe was found badly cracked. Steam was shut off, and the nature of the trouble was easily determined. The valve chamber was in the middle of the large pipes and the pipes on either side were stronger than the chamber. There being no expansion joints on the pipes the chamber cracked, as the temperature of the pipes increased and decreased. The problem was to remedy this. The pipe was parted at the flange joint, and from the inside of the chamber the work was performed. Holes were bored on the inside of the casting on either side of the crack, but they were not allowed to pierce the outer covering entirely. A half-moon shaped piece of metal was placed on the inside covering of the crack, bolts being put through and screwed in the holes made in the casting. This held the separating parts together and prevented the cracks growing wider. The pressure when the steam was turned on aided in keeping the protecting attachment in place. The pipe was joined again and the steam turned on. Though the Empress had been greatly delayed he made up the lost time and arrived on time.

CLEANING CASTINGS WITH SAND BLAST.

The use of the sand blast dates back over 30 years, but it is only within the past 10 years that it has been used in foundries. Now many foundries are equipped with air compressors. In a lecture before the Foundrymen's Association of Philadelphia the speaker said: The machine itself should be strongly built to stand rough usage of unskilled labor. As damp sand will clog up any sand blast, hand holes should be so located that the obstruction can be removed at once without much trouble.

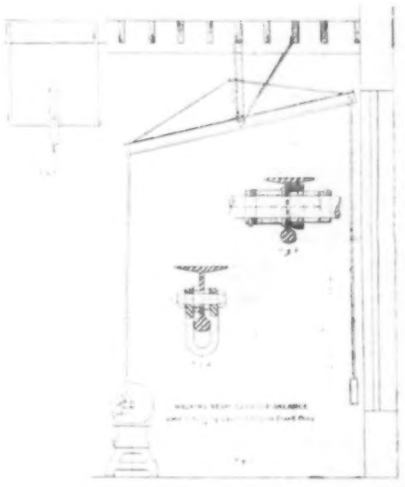
Where the sand blast is used on a large scale, it is an advantage to have an arrangement for preparing the sand to use over again. In this case, a hopper is located in the center of the room, or to one side, and covered with a grating. The hopper discharges into an elevator boat from which it is elevated and fed into a revolving or oscillating screen, where the fine sand is screened out into a dust box and the tailings fall into the sand box, which is above the sand blast. From the sand box the sand is fed back into the sand blast as required.

For cleaning large amounts of small castings, a sand blast tumbling barrel is used to advantage. Capacities of these barrels vary from 5 to 10 tons a day. The barrel mounted on rollers is filled less than half full and caused to revolve very slowly, say three or four revolutions per minute. The sand blast jets are introduced through the ends of the barrel, and as the barrel revolves, each casting comes in contact with the blast. The time required to clean one charge varies from 20 to 30 minutes. On castings to be machines there is a great saving on the tools in the machine shop. The sand blasted casting takes paint better and has a more finished appearance than a casting cleaned in any other way. In most cases where the sand blast is properly installed it should pay for itself in two or three years.

WALKING BEAM COUNTERBALANCE USED IN TURNING LAUNCH CRANK PINS.

Commander A. F. Dixon, U. S. Navy, describes the device in use at the Mare Island Navy Yard in a recent number of the Journal Am. Soc. Naval Engineers.

In turning the crank pins of a crank shaft the several difficulties increase with the length of the shaft and the number of cranks. The machine made and used in the steam engineering shops consists of a walking beam 10 feet 10 inches long, made by trussing a piece of 6-inch deck beam with a strap ⅜ inch by 2 inches, having in its center a properly constructed bearing through which is passed a 2-inch shaft of sufficient length to admit of any required movement of the beam parallel with the lathe. The shaft rests in strap hangers secured to the timbers above, and



bolted at the lower end by a bolt that passes through the hanger, shaft and brace. This makes a simple but efficient support for the beam. At each end of the beam is a bearing for the attachment of a clevis from which detachable hook rods are hung. A weight sufficient to balance the shaft to be turned, is secured to one of these rods, the rod being of such length as to suspend the weight but slightly above the floor.

The shaft is rough turned and the crank webs removed before work upon the crank pins is begun. The beam having been adjusted, the broad hook is passed under a turned portion of the shaft and the lathe is ready. On the type Z crank shafts a counterweight exceeding 300 pounds was required, which makes apparent the necessity for a good bearing for the walking beam.

Referring to the accompanying sketches, Figs. 1 and 2 are elevations showing the beam and beam shaft as attached to the timbers of the second floor. Fig. 3 is a detail of the center bearing, and Fig. 4 a detail of the clevis bearings

Summer Course in Easy Mechanics For Boys.

By Wilbert S. Drew.

[This series, commenced in issue of June 28, will continue each week. It will give instructions which any boy can understand, how to use carpenter's tools and make things. In doing this only a few tools will be required, and cost of material will be small. The articles to be made will include a boat, table and similar subjects.]

BUILDING A 14 FOOT ROW BOAT—PART II.

Our boat is now ready to paint. The best of all materials for this purpose is pure white lead and linseed oil.

The priming, or first coat, should be very thin, composed chiefly of oil with just enough white lead to make it look white. Work this carefully into all corners and see that all parts are evenly covered. Let this dry at least one week; two weeks would be better.

When the priming coat is thoroughly dry apply the second coat, using paint considerably thicker than before, and when well hardened a third coat of any desired color may be applied, but white wears the longest and furnishes the best protection to the wood.

Now get out two cleats, each 1 inch thick, 2 inches wide and 1 foot in length and nail them to the bottom of the boat on the inside at such a distance in front of the middle seats that the rowers can brace their feet against them while rowing.

If a strip of inch stuff three inches wide is nailed lengthwise along the middle of the boat, on the outside, it will greatly stiffen the floor but this is not absolutely necessary.

Perhaps the most satisfactory way to get the oars would be to buy them ready made; but if you have succeeded in building the boat well it may be your ambition to make the oars; if so, proceed as follows:

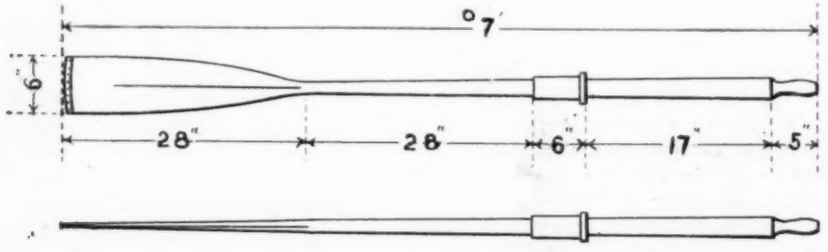
Get a piece of clear, straight grained spruce, soft maple, or white ash, the first being easiest to work, 15 feet long, 6 inches wide and 2¼ inches thick. Cut this in two at the middle and draw a line down the center of each piece for its entire length and then mark out the oars.

The diameter at the large end is 2¼ inches; the diameter at small end of blade is 1⅜ inches and of the handle 1½ inches.

If you live within reach of a shop where band sawing is done it will save much time and hard work to take the pieces there and get them sawed to the lines; but if not, procure a sharp hatchet and hew the pieces down as close to the lines as possible without cutting beyond them. When this is accomplished, hold the piece in the vise and use a spoke shave for rounding the shaft and handle.

The handle may be conveniently finished to shape with a coarse half round file or wood rasp. Rough out the blade with a draw shave and finish with a small plane.

The blade should have a ridge running along its center line and should slope each way like the roof of a house. This ridge becomes flatter as it nears the large end of the blade and about six inches from the end it disappears altogether, leaving that portion of the blade slightly rounded. The



end of the blade should be left about 3-16 inch thick and protected by a piece of sheet copper bent around the end and secured by copper tacks. The edges of the blade should be ⅛ inch thick and rounded.

A piece of leather should be passed around the shaft and tacked in the position shown while at the upper end of this a strip of leather ½ inch wide is rolled around the shaft until it forms a flange ⅜ inch high. The object of the leather is to keep the row lock from chafing the oar while the flange serves to keep the oar from slipping too far out in the row lock.

The oars should be sandpapered down to a smooth surface, after which they may be painted to match the boat or, better, given first a coat of linseed oil, then one of shellac and lastly a coat of spar varnish.

If it is necessary to lock the boat this may be done by driving a staple through the end and turning over the ends of the staple on the inside. A chain and padlock can then be attached.

HOW TO SET FUEL OIL BURNERS.

An expert in the South who has made a study of using fuel oil to best advantage sends us the following regarding the location of the burners under an ordinary return tubular boiler:

For a 60-inch boiler place two burners usually in the center of the ordinary doors and half way from the boiler to the grates. Let the inner ends be flush with the inside of the front wall.

Cover all grate surface with ¼-inch asbestos board, except the equivalent of about 64 square inches to each burner, and immediately under the same. On top of this place a full layer of fire brick on the flat. Do not lay them too close, but allow a little for expansion. Plaster this over with fire clay. At a point about 36 inches from the point of the burner, lay a cascade wall one brick length in thickness. Set these on edge. Leave half-inch spaces. Run this wall up to within as near four inches of the boilers as the courses will make. Leave more rather than under four inches. Follow the circle of the boiler as nearly as convenient and set the brick up in a little fire clay to steady them. In case the bridge wall is as much as twelve inches from the boiler, lay one course on edge around this. Keep the pit behind the bridge wall empty. Stop all holes in the furnace walls and breeching. Put brick filling in the fire doors, leaving a loose brick near burner for lighting and observing the fire. Leave ash pit doors in place. Direct the nozzles of the burners slightly downward so that they will strike the cascade wall about one-third of the way from the bottom.

The cascade wall serves very important purposes first, for storage of heat and then radiating it or giving it out and thus perfecting combustion which might not otherwise be complete, as any unconsumed gases could scarcely get through the small spaces in the highly heated bricks of the cascade wall without being burned.

MOSQUITOES CAUSE A STRIKE.

The climax of the mosquito plague was reached at Marinette, Wis., where a large part of a crew of Italians employed on the Wisconsin & Michigan Railway extension quit work on account of the insects and refused to stay any longer in the woods. They received their pay and returned to their homes in Chicago.

Employment agents were here seeking men to take the places of the strikers. It is thought the remainder of the men cannot be kept at work on account of the mosquitoes.

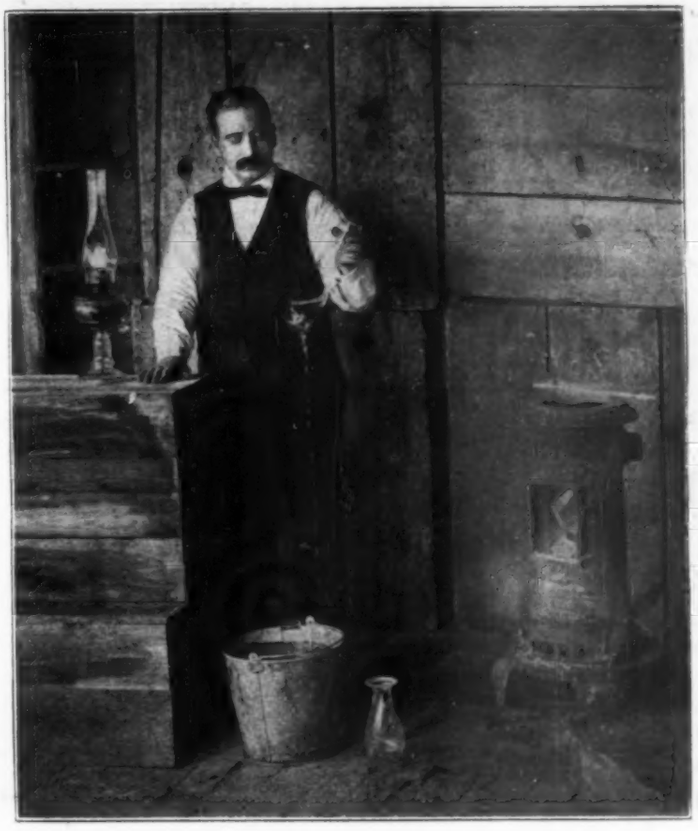
A big brother to the fountain pen is the fountain marking brush, which holds half a pint of ink at one filling.

INVENTS A MALLEABLE GLASS.

Achievement of an Indiana Man that Adds a New Chapter in Glass Making.

A lamp chimney that will not break on a lamp has at last been made. It results from a newly discovered process of making malleable glass, something the world has been searching for since the making of glass began hundreds of years before Christ. The Egyptians, the Phoenicians, the Greeks, the Romans and all nations since have strived in vain to make a glass that would mash before it would break. The problem has been solved by an Indiana man. His name is Louis Kauffeld and he lives in the town of Matthews, Ind. His may be regarded as the greatest achievement of the present age in the art of glass manufacture.

The secret of making the glass the Indianan refuses to divulge, but he gave ample tests with the finished product to prove its malleability. It seems impossible to break it from the effects of heat. Water was boiled in a lamp chimney made from the glass and another of the chimneys was placed over a fire and permitted to attain such a heat that one side shrunk in as if it were beginning to melt. In neither instance was there any sign of a crack. The glass appears to be clearer than the ordinary product and is more elastic in its molten state. Mr. Kauffeld, who is at the head of the Kauffeld Glass Company, claims that his glass contains neither lime nor lead, and at present is only manufacturing lamp chimneys, such as are made in an off-hand factory.



The Water Test.

Testing Chimney in Forge.

VALUABLE METHOD OF PRESERVING BLUE PRINTS.

The superintendent of a large car shop thus describes his method of preserving blue prints to the Street Railway Journal: His first method was to fasten the prints on ordinary flat sheets of pasteboard. These answered fairly well for a time and kept the prints flat, but the pasteboard became broken and oil-spotted. He then hit upon the idea of using thin sheet iron as a backing, and this proved eminently satisfactory. All the prints in common use in the shop were first pasted on these pieces of sheet iron, then both sides were varnished over, so as to make the paper oil and waterproof. After being subjected to this treatment, these prints can be hung up near the machines. They are always flat, clean and clear, and they can be filed away in small shape when not in use. Moreover, they are practically indestructible, because when soiled they can be put under the hose and washed off. The plan has been in use for about six years, and has proved very satisfactory.

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CEMENT FOR PIPE JOINTS.

At a recent meeting of the Ohio Gas Light Association in Columbus, Mr. George Light recommended a cement for pipe joints, consisting of a mixture of ordinary pine tar and dry oxide of iron. This cement, Mr. Light stated, is as good in a faced or rough flange joint as red-lead putty, costs about one-tenth as much, does not harden as quickly as red lead, and is very adhesive under pressure.

QUEER COMBINATION OF MENTAL, PHYSICAL AND MECHANICAL FORCES.

Here is an odd combination of physical power, mechanical power and mental power, which for quick work and economy of labor has surprised even its builders. The scoop shovels, as shown in the illustration, are attached to ropes and are raised and lowered automatically. The man who holds the handle keeps time with the motion and his physical exertion is thus reduced to the minimum. The shovels are three times the size of the ordinary hand track shovel, and each man deposits eleven large shovelsful of dirt into the hopper every minute. The inclined conveyors or elevators receive the dirt or gravel and dump it into the ballast car. The machine is known as the "Torry Ballast Loader." The men using the shovels may cut the bank away on a level with the under side of the ties to a distance of ten feet or more from the hoppers.

WHEELED CONDUIT RODS.

In drawing wires into underground conduit rods are often used. A recent invention for doing this work consists of

wooden rods in short lengths to be quickly coupled, and provided with wheels to make an easy passage. J. S. Barron & Co., New York, have put on the market the wheeled device shown in the cut.

VOLCANIC-MUD MAKES DANGEROUS BALLAST.

It is dangerous to ballast ships with volcanic-mud. The Journal of Commerce, Melbourne, May 20th, relates the arrival of a crew which had been picked up 750 miles from land after abandoning their ship. The volcanic-mud ballast absorbed enough moisture to liquefy, and shifted, thus tilting the vessel over.

To Whom It May Concern:

I have opened an office at Rooms 1520-21 Marquette Bldg., 204 Dearborn St., Chicago, for securing Patents, Trade-marks and Copyrights in the United States and Foreign countries.

Having been actively engaged in practice before the Patent Office at Washington, D. C., and the United States Courts since 1881, during which time I have conducted nearly one thousand patent cases, I feel qualified to offer my services to those who are interested in patents as inventors, investors and manufacturers. My office in Washington will be retained in charge of a competent associate, so that clients will have the advantage of direct representation at the Patent Office as well as of personal consultation with their attorney. After patents are obtained, I will assist clients in disposing of their patent rights to the best advantage.

Books on Patents, and references will be furnished upon request

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FOR SALE—U. S. Patent No. 695,793, dated March 18, 1902. Setting instrument. A tool every machinist should have. Used for different purposes. Will sell entire patent. For descriptive circulars address Morris Chamberlain, Barnley, N. J.

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STEAM PLOWS.

Please give me the names and address of some firms making steam plows.—G. R. H., Nashville, Tenn.

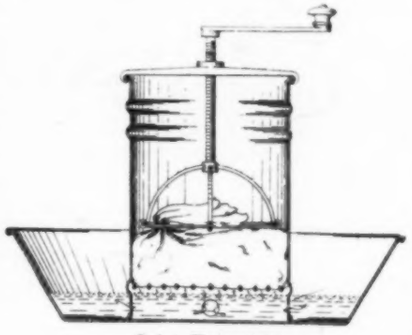
Answer:—Spalding-Robbins Rotary Disc Plow Co., Philadelphia; Deere Plow Co., Moline, Ill.; J. I. Case Co., Racine, Wis.

WANTS SMOKE CONSUMER FOR SCHOOL HOUSE.

I am chairman of committee which is rebuilding our school house and we would like to install some device which will prevent, or at least reduce, the smoke. We burn soft coal. I know there are several devices which would cost us a number of thousand dollars. Are there any cheaper devices, and who make them? We would send our superintendent 500 miles to purchase a serviceable device.—R. L.

FRUIT JUICE EXTRACTOR.

This is the invention of a Denver woman. The fruit is placed in a bag and set



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HEAT FUEL OIL BEFORE BURNING.

Fuel oil is being used extensively on sugar plantations in the South. A writer in the Louisiana Sugar Planter has made an inspection of many plants, and the following is from his report: Oil must be sprayed to burn successfully, the finer the atomizer the better. Steam is the best medium for spraying and should be as dry as possible, and must be of greatly ample supply. Insurance companies have ruled against the tank and gravity feed, though it works more evenly than a pump. Fuel oil is safe unless fed faster than it can be burned. In order to secure the best results the oil should be heated at or very near the burners. An efficient heater for this purpose may be made as follows: Take a piece of four-inch pipe leading across the furnace (if not too long, if over eight or ten feet at most, make two heaters), cap one end, at the other end place a 4-inch by 4-inch by 1-inch T, the 1-inch side serving as a feed inlet. Put a close 4-inch nipple in other end of the T and on the end of this nipple place a 4-inch by 2-inch reducer, tapped from the inside, before putting it on, screw a piece of 2-inch pipe having a long thread. This pipe should be about 6 inches shorter than the 4-inch pipe which when fitted up surrounds it. Cap the inside end of the 2-inch pipe. We thus have a 2-inch pipe for steam, inside of a 4-inch pipe, into which latter the oil is pumped. This pipe is tapped at suitable intervals with half-inch gas pipe to supply oil to the burners. Oil pipe holes for burners should be tapped on the top side in order to get the hottest oil. The 1-inch side of the feeding T should be turned downward so as to feed oil at the bottom. The long 2-inch thread projecting through the reducer can have a 2-inch by 1-inch by ½-inch T placed at end, the 1-inch end serving as a steam inlet, and the ½-inch side of the T serving as the outlet or drain for the heater, which should have its condensation trapped away The objection to having the inner pipe project through oil pipe at both ends is the difficulty of keeping joints tight, because of unequal expansion of the two pipes. A heater of this class should be slightly depressed at the steam end to secure a fall for the condensation toward the outlet for the water. An 8-foot piece of such heater will be abundant for heating the oil for two 150 h. p. boilers. The heating of the oil is of sufficient importance to justify the most painstaking care to secure it.

AFRICA HAS A GREAT FUTURE.

When the white man gets full possession of Africa, it is likely to rival the resources of the United States. Few people have any idea of what already has been done there, or of its remarkable possibilities. There are now 12,500 miles of railroad. In 1901 the commerce of the continent was $700,000,000. The United States sold $25,000,000 worth of goods last year, largely machinery. The gold production of the Rand in 18 years was $300,000,000, and the Kimberly diamonds in 30 years amounted to $350,000,000. Now that the war is over, development will progress in great bounds.

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